

Investigation of the Ductility Improvement of Replaceable Hinge Member on Different Types of Precast Concrete Frames

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Abstract : The demand for precast reinforced concrete (RC) structures is growing, considering their certain benefits, including faster assembly, homogeneous materials, and high-quality labor. The structural integrity of precast reinforced concrete (RC) constructions is influenced by the effectiveness of the joints and connections. This paper contains an analytical study about four types of precast reinforced concrete frames, which vary according to the number of storeys and the number of bays with two different types of moment-resisting beam-to-column connection is investigated under cyclic displacement loading up to 5.6% drift rate by using ABAQUS software. The first connection type is the widely used moment-resisting connection that is defined as a wet connection in Turkish Seismic Code (TBDY). The second connection type is known as Artificial Controllable Plastic Hinge. The goal of this connection is to defend reinforced concrete components from earthquake-related plastic deformations by keeping them in a specialized connecting section. It will be possible to repair the broken connections after the earthquake. The cyclic behavior of the four types of frames with the mechanical plastic hinge and wet connection was analytically investigated, and then comparisons and suggestions were made on period, ductility, and structural system behavior coefficient. The analytical study shows that the replaceable plastic hinge element provides a significant period increase. Especially in the case of two storeys and two bays, the change in the period was felt the most compared to other frames. The results for ductility show a significant change in the ductility of the frames with replaceable plastic hinges. For the structural system behavior coefficient, a recommendation between 3.90 and 4.52 values was made.

Keywords : precast structures, replaceable plastic hinge, beam to column connections, ductility

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